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(54) Abstract Title
Premoistened wipe with improved opacity

(57) A premoistened wipe incorporates an opacifying agent such as titanium dioxide so as to increase its opacity. The wipe may be made from pulp fibres 100 and synthetic fibres 200 by means of an airlaying apparatus 300. The airlaid web 500 may be wetted at 730, embossed at 742 and sprayed with binder containing the opacifying agent at 820,830. The web is dried and the binder cured in ovens 900.

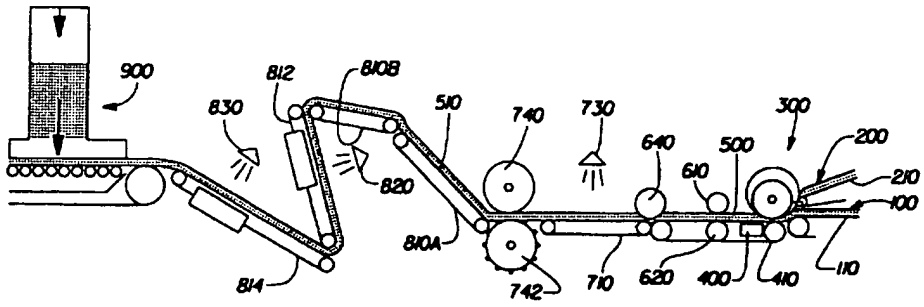

FIG.4

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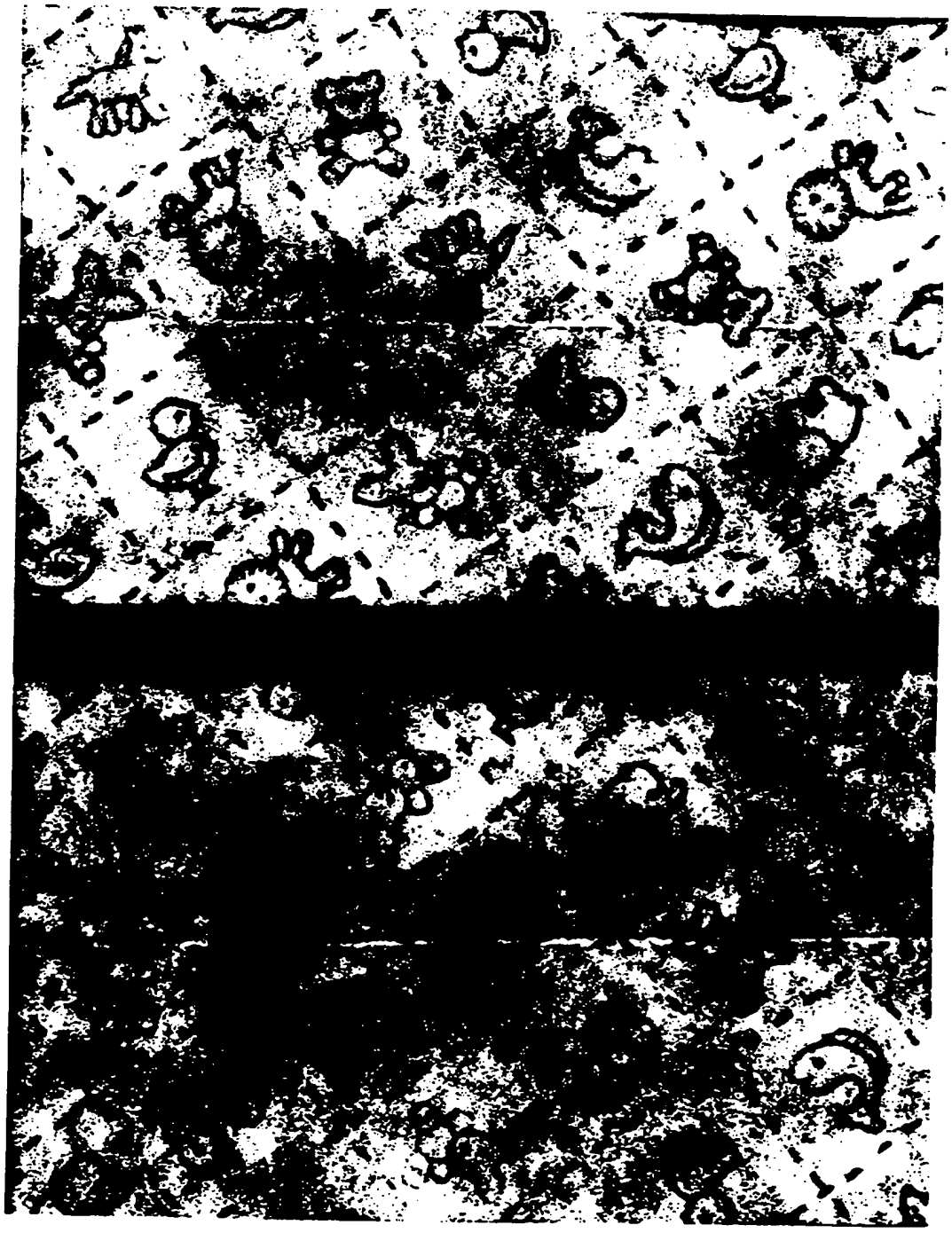

FIG.1

FIG.2

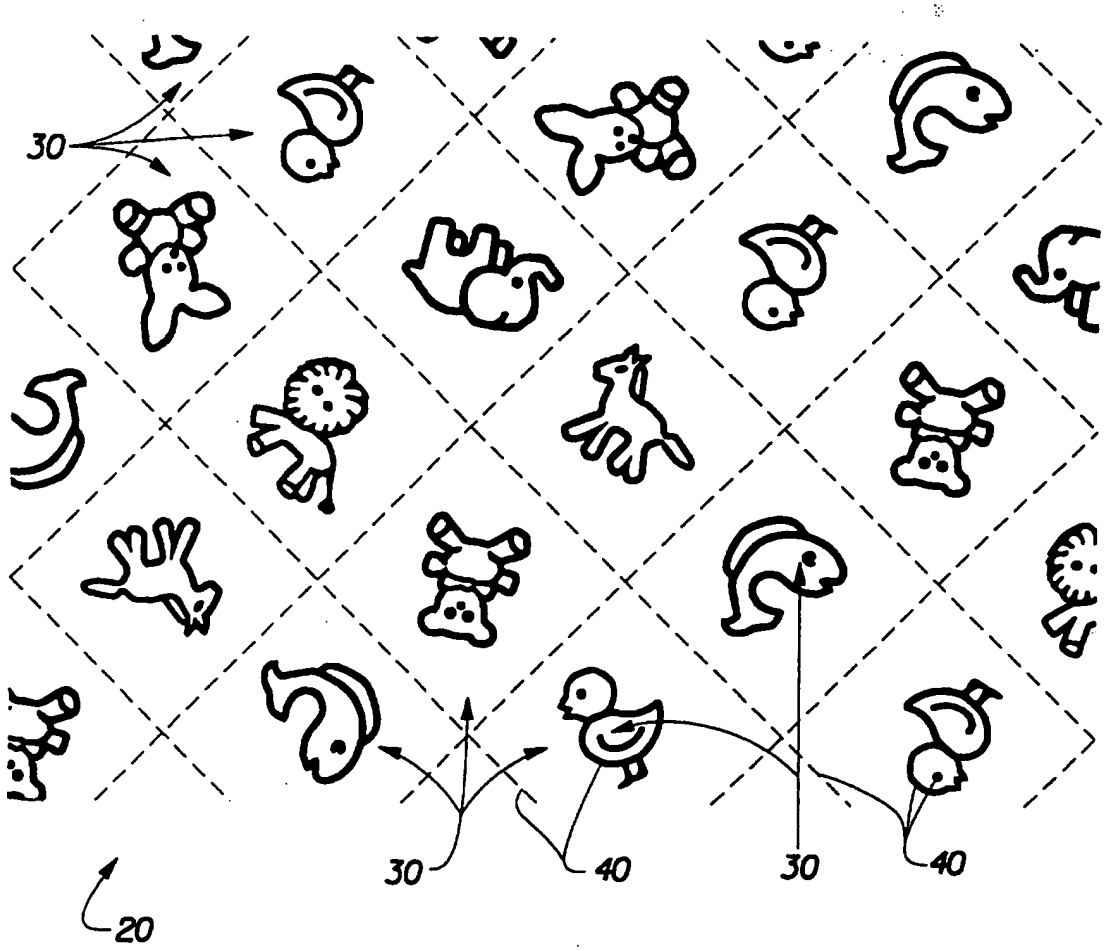

FIG.3

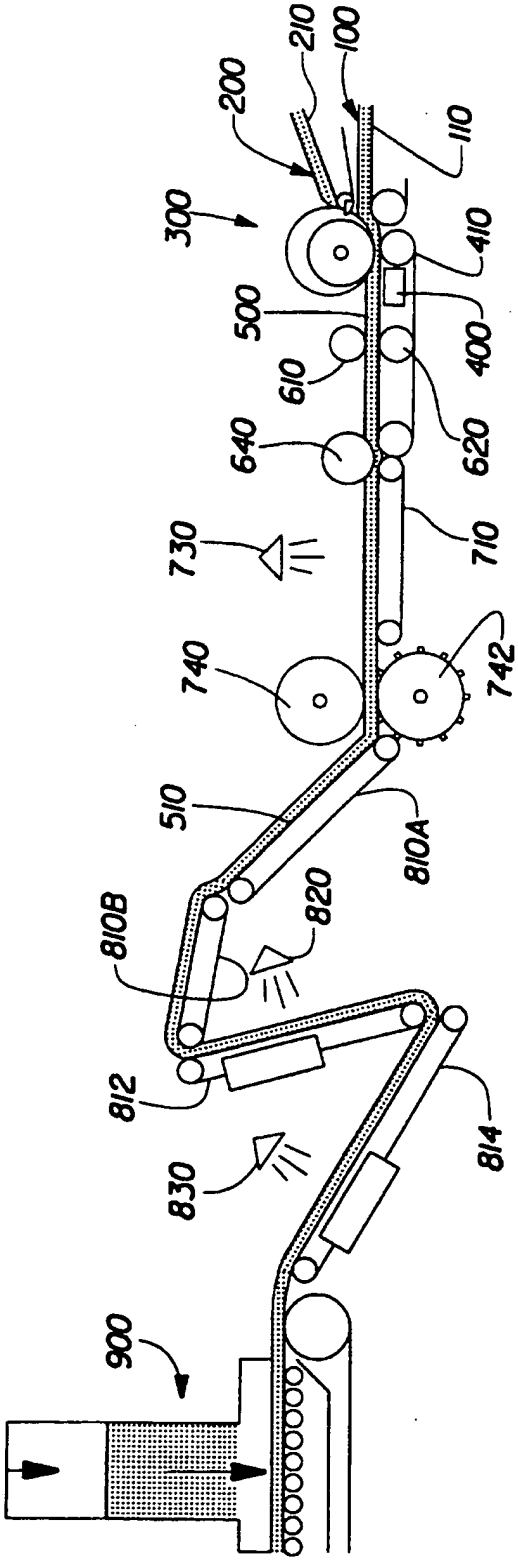
210
100
200
110
300
410
500
400
610
620
640
710
730
740
742
510
810A
820
810B
812
814
830
900

FIG.4

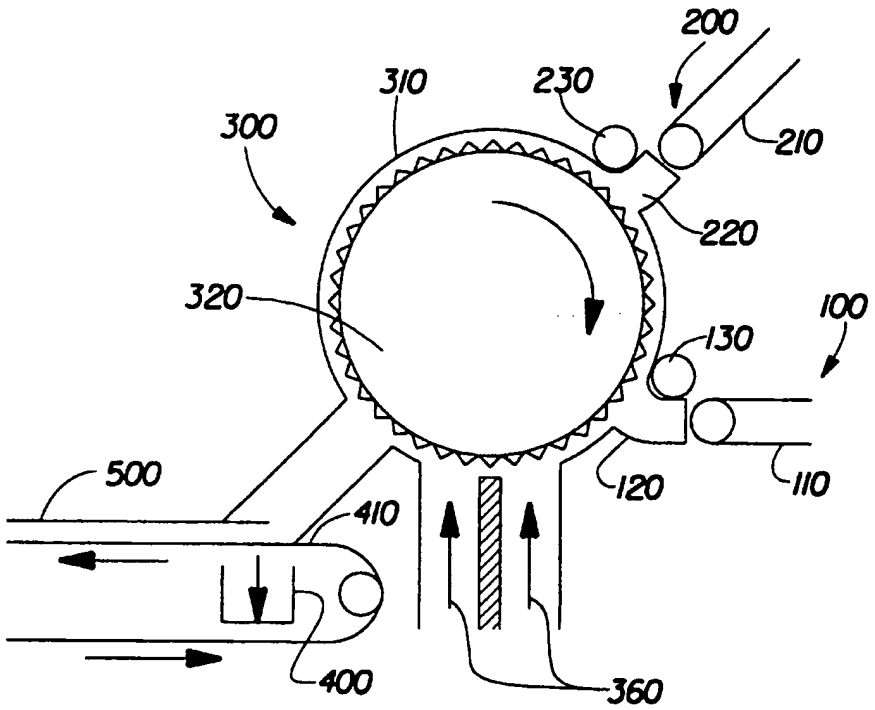

FIG.5

DISPOSABLE PREMOISTENED WIPE HAVING OPACITY AGENT

FIELD OF THE INVENTION

The present invention relates to disposable premoistened wipes, and more particularly to a disposable premoistened wipe including an opacifying agent.

BACKGROUND OF THE INVENTION

Premoistened wipes are well known in the art. Such wipes are also referred to as "wet wipes" and "towelettes." Premoistened wipes include a substrate, such as a nonwoven web of fibers, which is wetted with a liquid composition prior to use.

Such premoistened wipes can be used for removal of a substance from a surface or object which is animate or inanimate. For instance, premoistened wipes can be used for human cleansing and wiping, such as for anal cleansing, perineal cleansing, genital cleansing, and face and hand cleansing.

Premoistened wipes known in the art can include a substrate in the form of an airlaid nonwoven web of fibers. The substrate can be formed by air laying a blend of natural and synthetic fibers to form a fibrous web, spraying water on the web, and then embossing the web. A latex binder can then be applied to the web, followed by curing of the latex binder in an oven. The nonwoven web is then premoistened with an aqueous liquid composition. An example of such a premoistened web is commercially available as "Pampers Baby Fresh" brand baby wipes marketed by The Procter & Gamble Company of Cincinnati, Ohio.

The following patents disclose methods or apparatus for forming webs: U.S. Patent 3,862,472 issued Jan. 28, 1975 to Norton et al.; U.S. Patent 3,918,126, issued Nov. 11, 1975 to Wood; U.S. Patent 3,982,302 issued Sept. 28, 1976 to Vaalburg; U.S. Patent 4,004,323 issued Jan. 25, 1977 to Gotchel et al.; U.S. Patent 4,014,635 issued March 29, 1977 to Kroyer; U.S. Patent 4,064,600 issued Dec. 27, 1977 to Gotchel et al.; U.S. Patent 4,074,393 issued Feb. 21, 1978 to Hicklin et al.;

U.S. Patent 4,097,965 issued July 4, 1978 to Gotchel et al.; U.S. patent 4,130,915 issued Dec. 26, 1978 to Gotchel et al.; U.S. Patent 4,144,619 issued March 20, 1979 to White et al.; U.S. Patent 4,176,426 issued Dec. 4, 1979; U.S. Patent 4,207,367 issued June 10, 1980 to Baker; U.S. Patent 4,315,347 issued Feb. 16, 1982 to Austin et al.; U.S. Patent 4,640,810 issued Feb. 3, 1987 to Laursen et al..

One object of the present invention is to provide a premoistened wipe having improved opacity.

Another object of the present invention is to increase the opacity of a premoistened wipe having a substrate comprising at least 50 percent by weight cellulosic fibers.

Another object of the present invention is to provide a method for incorporating an opacifying agent in a nonwoven web of fibers.

SUMMARY OF THE INVENTION

Applicant has recognized that one problem with premoistened wipes is that the liquid composition with which the substrate is impregnated can reduce the opacity of the wipe. Reduction of opacity on wetting is undesirable because end users of premoistened wipes may perceive a relatively low opacity as indicating a thin, or low quality wipe.

Reduction in opacity due to wetting is especially a problem in those cases where the wipe substrate comprises a substantial amount of cellulosic fibers. The wet opacity of the wipe substrate could be improved by reducing the amount of cellulosic fibers in the substrate, and in their place substituting relatively fine denier synthetic fibers. However, such a substitution is undesirable from a cost standpoint. Further, it can be desirable from an ecological standpoint to use natural fibers, such as cellulosic fibers, so that at least portions of the substrate are more biodegradeable relative to all synthetic compositions.

The present invention provides a premoistened wipe having improved wet opacity. According to one aspect of the invention, a premoistened wipe is provided comprising an airlaid substrate impregnated with an aqueous liquid composition, wherein the premoistened wipe has an average normalized wet opacity of at least about 66, more preferably at least about 68, still more preferably at least about 70, and even more preferably at least about 71. The average normalized wet opacity is

determined based on measured values of opacity of the premoistened wipe, liquid loading of the premoistened wipe, and basis weight of the dry substrate, as described below.

The premoistened wipe of the present invention can have an average liquid loading of at least 1.0 grams, more preferably at least about 1.5 grams, still more preferably at least about 2.0 grams, and even more preferably at least about 2.5 grams per gram of dry substrate. In one embodiment, the premoistened wipe has an average liquid loading of at least about 3.0 grams of liquid composition per gram of dry substrate.

Further, the substrate can have a dry density of less than about 0.10 grams per cubic centimeter, and more preferably less than about 0.075 grams per cubic centimeter. Accordingly, the present invention provides a relatively high opacity with the use of a relatively high liquid loading and a relatively low density substrate.

The premoistened wipe can have a substrate comprising a nonwoven web of fibers. The nonwoven web can have a dry basis weight of at least 40 grams/square meter, and the basis weight can be between about 40 and about 80 grams/square meter. The nonwoven web can comprise at least about 50 percent, and in one embodiment at least about 70 percent by dry weight cellulosic fibers. The nonwoven web can also include staple length synthetic fibers having a denier greater than about 1.0 gram/9000 meter of fiber length.

In one embodiment, the premoistened wipe includes a plurality of embossed regions dispersed throughout a background region of the nonwoven web, wherein the embossed regions are relatively less opaque than the background region.

According to another aspect of the present invention, a premoistened wipe is provided having an airlaid nonwoven web impregnated with an aqueous liquid composition, wherein the nonwoven web includes an opacifying agent. The opacifying agent can have an index of refraction greater than that of water (about 1.33), and more preferably has an index of refraction greater than that of cellulose (about 1.53). In one embodiment of the present invention, the opacifying agent has an index of refraction greater than about 1.40, more preferably greater than about 1.60, and even more preferably greater than about 2.00.

In one embodiment, the opacifying agent comprises a white pigment. In a preferred embodiment, the opacifying agent comprises titanium dioxide. The

nonwoven web can comprise between about 0.3 percent and about 1.0 percent by dry weight titanium dioxide.

According to another aspect of the present invention, a method for forming a nonwoven web is provided. The method includes the steps of forming an airlaid web of fibers; and adding an opacifying agent comprising titanium dioxide to the airlaid web of fibers. The method can include the step of forming an airlaid web of fibers comprising at least 50 percent, and more particularly at least 70 percent, by dry weight cellulosic fibers.

In one embodiment, the method comprises the steps of wetting the web, followed by embossing the web, followed by applying an adhesive binder composition to the web, wherein the binder comprises titanium dioxide.

Surprisingly, the addition of the opacifying agent to the binder according to the present invention improves the wet opacity of the background region of the premoistened wipe, yet the difference in opacity between embossed regions and the background region is not lost. Accordingly, the present invention provides the benefit of improved wet opacity while maintaining the visual distinctiveness of an embossed pattern.

BRIEF DESCRIPTION OF THE DRAWINGS

While the Specification concludes with claims particularly pointing out and distinctly claiming the present invention, it is believed that the same will be better understood by the following Specification taken in conjunction with the associated drawings in which like components are given the same reference numeral, and:

Figure 1 is a photograph of a digital image of two premoistened wipes positioned on a black background. The wipe designated by numeral 20 in Figure 1 comprises titanium dioxide according to the present invention, while the wipe designated by numeral 21 does not include titanium dioxide.

Figure 2 is a photograph, with back lighting, of an enlarged portion of a premoistened wipe according to the present invention and having embossed regions which are relatively less opaque than a background region.

Figure 3 is a schematic illustration of a premoistened wipe having embossed regions.

Figure 4 is a schematic illustration of a process for forming an airlaid web of fibers according to the present invention.

Figure 5 is an enlarged schematic illustration of the airlaying apparatus shown in Figure 4.

DETAILED DESCRIPTION OF THE INVENTION

The premoistened wipe of the present invention comprises a substrate wetted with a liquid composition. The premoistened wipe has an average normalized wet opacity of at least about 66, more preferably at least about 68, still more preferably at least about 70, and even more preferably at least about 71.

The term "liquid composition" includes any composition including a liquid phase, including but not limited to emulsions having a liquid phase.

The average normalized wet opacity is calculated based on measured values of opacity of the premoistened wipe, liquid loading of the premoistened wipe, and basis weight of the dry substrate. The procedure for measuring the opacity, and the method of calculating the average normalized wet opacity, are described below in "Test Methods."

In a preferred embodiment of the present invention, the premoistened wipe comprises a nonwoven substrate, the substrate including an opacifying agent. The opacifying agent can have an index of refraction greater than that of water (about 1.33), and more preferably has an index of refraction greater than that of cellulose (about 1.53). In one embodiment of the present invention, the opacifying agent has an index of refraction greater than about 1.40, more preferably greater than about 1.60, and even more preferably greater than about 2.00.

In one embodiment, the opacifying agent comprises a white pigment. In a preferred embodiment, the opacifying agent comprises titanium dioxide. The nonwoven web can comprise titanium dioxide, anatase, titanium dioxide, rutile, or a combination thereof.

The nonwoven web can comprise at least about 0.3 percent, and more preferably at least about 0.5 percent by dry weight titanium dioxide. The nonwoven web can comprise between about 0.3 percent and about 1.0 percent by dry weight titanium dioxide.

Other suitable opacifying agents include, but are not limited to clay, calcium carbonate, zinc oxide, and diatomaceous silica.

The premoistened wipe has an average liquid loading of at least 1.0 grams, more preferably at least about 1.5 grams, still more preferably at least about 2.0 grams, and even more preferably at least about 2.5 grams per gram of dry substrate. In one embodiment, the premoistened wipe has an average liquid loading of at least about 3.0 grams of liquid composition per gram of dry substrate.

The substrate can have a dry density of less than about 0.10 grams per cubic centimeter, and more particularly, the substrate can have a dry density of less than about 0.075 grams per cubic centimeter. Accordingly, the present invention provides a desirable level of opacity in a premoistened wipe having a relatively high liquid loading level and a relatively low density.

The dry substrate can be wetted with an aqueous liquid composition (at least 50 percent by weight water). The liquid composition can include a number of ingredients in addition to water, including but not limited to preservatives, surfactants, emollients, moisturizers (including but not limited to humectants and skin conditioning agents), fragrances, and fragrance solubilizers, as well as other ingredients. The liquid composition is preferably at least 85 percent by weight water. The dry substrate can be premoistened with about 1.5 grams to about 4.5 grams of the liquid composition per gram of the dry substrate, and in one embodiment, between about 2.5 and 3.5 grams of liquid composition per gram of dry substrate.

Preferably, the substrate is premoistened with a liquid composition comprising at least 85 percent by weight water and an effective amount of a surfactant, an effective amount of an emollient, an effective amount of preservative, an effective amount of a humectant, an effective amount of a fragrance, and an effective amount of a fragrance solubilizer.

In one embodiment, the liquid composition includes at least about 95 percent by weight water. The liquid composition can also include about 0.5-5.0 percent by weight Propylene Glycol, which can serve as an emollient and humectant; about 0.1-3.0 percent by weight PEG-75 Lanolin, which can serve as an emollient; about 0.1-3.0 percent by weight Cocoamphodiacetate, which can serve as a surfactant for cleansing the skin; about 0.1-3.0 percent by weight Polysorbate 20, which can serve as a surfactant for cleansing the skin and as an emulsifier for solubilizing fragrance components; about 0.01-0.3 percent by weight Methylparaben, which can serve as a

preservative; about 0.005-0.10 percent by weight Propylparaben, which can serve as a preservative; about 0.005-0.10 percent by weight 2-Bromo-2-Nitropropane-1, 3-Diol, which can serve as a preservative; and about 0.02-1.0 percent by weight of a fragrance component.

Other liquid compositions with which the substrate can be moistened are described in the following patent documents which are incorporated herein by reference: U.S. Patent 4,941,995 issued July 17, 1990 to Richards et al.; U.S. Patent 4,904,524 issued February 27, 1990 to Yoh; U.S. Patent 4,772,501 issued September 20, 1988 to Johnson et al..

The substrate can comprise fibers and/or filamentary material, and can be formed from woven materials, nonwoven materials, paper webs, or the like. Particularly preferred materials are nonwoven webs having fibers or filaments distributed randomly as in "airlaying" or certain "wet laying" processes, or with a degree of orientation, as in certain "wet laying" and "carding" processes.

The fibers or filaments of the substrate can be natural, or of natural origin (e.g. cellulosic fibers such as wood pulp fibers, cotton, and rayon fibers) or synthetic (e.g. polyolefins, polyamides or polyesters), or combinations of natural and synthetic fibers.

In one embodiment of the present invention, the substrate comprises at least 50 percent by dry fiber weight cellulosic fibers. More particularly, the substrate can comprise at least 70 percent by dry weight cellulosic fibers. The substrate can also comprise synthetic fibers having a denier greater than about 1.0 grams per 9000 meters of fiber length, and the fibers having staple length of less than 1.0 inch. Accordingly, the present invention provides a desirable level of wet opacity in a premoistened wipe having a substrate comprising a relatively high level of cellulosic fibers. Further, a desirable level of wet opacity is achieved without the use of relatively fine, relatively low denier synthetic fibers.

Moreover, the present invention can provide a desirable level of wet opacity using relatively high density synthetic fibers. Generally, for a given denier and a given basis weight, a web formed from synthetic fibers made of a relatively high density material will include less of the synthetic fibers per unit area than will a web formed from synthetic fibers made of a relatively lower density material. Accordingly, the use of synthetic fibers having a relatively high density would be

expected to result in a relatively low opacity as compared to the opacity achievable with synthetic fibers having a relatively low density.

The present invention can provide a desirable level of wet opacity in a premoistened wipe having a substrate including synthetic fibers having a density greater than 1.0 gram per cubic centimeter. In particular, the present invention can provide a desirable level of wet opacity in a premoistened wipe comprising polyester fibers, polyester fibers having a density of about 1.38 grams per cubic centimeter. In comparison, polypropylene fibers have a density between about 0.90 and about 0.96 grams per cubic centimeter.

According to one preferred embodiment of the present invention, the premoistened wipe comprises an airlaid nonwoven web comprising at least about 70 percent by dry weight cellulosic fibers, less than 20 percent by weight synthetic fibers, and at least 5 percent by dry weight of an adhesive binder. In one preferred embodiment, the opacifying agent is added to the adhesive binder.

A premoistened wipe according to the present invention can comprise an airlaid nonwoven web comprising, based on dry substrate weight, between about 70 percent and about 80 percent by weight cellulosic fibers, between about 10 percent and about 15 percent by weight polyester fibers, and between about 10 percent and about 20 percent by weight adhesive binder. The adhesive binder can comprise a latex (styrene butadiene) adhesive. The adhesive binder can include an opacifying agent such as titanium dioxide in the amount equal to at least about 2 percent, more preferably at least about 4 percent of the latex solids weight, and still more preferably at least about 5 percent of the latex solids weight.

Figure 1 is a photograph of a digital image of a premoistened wipe designated by the numeral 20, the wipe 20 comprising titanium dioxide according to the present invention. Figure 1 also shows a second premoistened wipe designated by numeral 21, the wipe 21 having generally the same fiber composition, basis weight, liquid loading as the wipe 20, but the wipe 21 not including titanium dioxide. The wipes in Figure 1 are embossed and have a background and visually distinguishable embossed regions which are relatively less opaque than the background.

The image in Figure 1 was prepared by placing the premoistened wipes on a AGFA Arcus II Color Scanner and covered with a piece of exposed x-ray film. The x-ray film provides a uniform opaque black background for the samples. The samples were scanned using the AGFA FotoLook v2.09 plugin for Adobe Photoshop 4.0

running on a Dell Dimension XPS-266 personal computer. The FotoLook plugin was set to scan in 8 bit gray scale at 300dpi and the grayscale calibration was set to Automatic. The resulting image was read directly into Photoshop and saved as a TIFF format image. The Adjust tool in Photoshop was used to increase the contrast and reduce the brightness prior to printing.

Figure 2 is a photograph of a premoistened wipe 20 according to the present invention, the photograph made with back lighting. Figure 2 illustrates embossed regions which are relatively less opaque than the background region.

Figure 3 is a schematic illustration of a wipe according to the present invention, the wipe is designated generally by numeral 20, the background is designated generally by numeral 30, and the embossed regions are designated generally by reference numeral 40.

Method of Making Nonwoven Web:

The premoistened wipe of the present invention can have an airlaid nonwoven web made according to the following method.

A source of pulp fibers, such as pulp drylap in roll form, is provided. A separate source of synthetic fibers, such as bales of polyester fibers, is provided.

The rolled pulp is unwound, and pulp fibers are individualized by a series of hammermills, as is known in the art. The individualized pulp fibers are consolidated to form a mat of pulp fibers. The mat is humidified to have a moisture level of between about 11 and 13 percent (11 to 13 grams of water per 100 grams of dry fiber). The pulp mat is designated 100 in Figure 4, and is shown being carried on a conveyor 110 toward a web airlaying apparatus 300.

Separately, the baled synthetic fibers are individualized to provide a mat of synthetic fibers. The fibers can be individualized in any suitable manner known in the art, such as by progressively opening fiber bundles in stages. Referring to Figures 4 and 5, the mat of synthetic fibers is designated 200 in Figure 4, and is shown being carried on a conveyor 210 toward the web airlaying apparatus 300.

The mat 100 enters the web airlaying apparatus 300 through a nosebar 120, roller 130 arrangement, and the mat 200 enters the apparatus 300 through a nosebar

220 and roller 230 arrangement. The nosebar/roller arrangements provide even metering of the mats.

The airlaying apparatus 300 includes a housing 310 and a rotating element 320 disposed within the housing 310. The apparatus 300 also includes a source of pressurized air, the pressurized air being designated 360 in Figure 4. The rotating element has a toothed surface which aids in carrying the fibers from the mats 100 and 200 and injecting the fibers from the mats 100 and 200 into the pressurized air 360 so that the fibers are entrained in and generally unformily mixed by the air 360.

A vacuum device 400 is associated with an air pervious forming screen 410. The vacuum device 400 draws the mixed fibers provided by the airlaying apparatus 300 onto the forming screen 410 to provide an airlaid web 500 comprising the pulp fibers and the polyester fibers, the web having a basis weight of about 50-60 grams per square meter.

While the apparatus 300 is shown for providing the airlaid web 500, it will be understood that other airlaying techniques can be used to provide an airlaid web 500, as are known in the art. The following patents are incorporated herein by reference for the purpose of disclosing airlaying methods and/or apparatus: U.S. Patent 3,862,472 issued Jan. 28, 1975 to Norton et al.; U.S. Patent 3,918,126, issued Nov. 11, 1975 to Wood; U.S. Patent 3,982,302 issued Sept. 28, 1976 to Vaalburg; U.S. Patent 4,004,323 issued Jan. 25, 1977 to Gotchel et al.; U.S. Patent 4,014,635 issued March 29, 1977 to Kroyer; U.S. Patent 4,064,600 issued Dec. 27, 1977 to Gotchel et al.; U.S. Patent 4,074,393 issued Feb. 21, 1978 to Hicklin et al.; U.S. Patent 4,097,965 issued July 4, 1978 to Gotchel et al.; U.S. patent 4,130,915 issued Dec. 26, 1978 to Gotchel et al.; U.S. Patent 4,144,619 issued March 20, 1979 to White et al.; U.S. Patent 4,176,426 issued Dec. 4, 1979; U.S. Patent 4,207,367 issued June 10, 1980 to Baker; U.S. Patent 4,315,347 issued Feb. 16, 1982 to Austin et al.; U.S. Patent 4,640,810 issued Feb. 3, 1987 to Laursen et al., and Re. 31,775 reissued Dec. 25, 1984.

The airlaid web 500 is carried through a nip formed between rolls 610 and 620 to provide low level consolidation of the web 500. A vacuum transfer roll 640 is then used to transfer the web 500 from the forming wire 410 to a conveyor 710.

The web 500 is wetted while being carried on conveyor 710. A plurality of nozzles designated 730 direct water on to the upper surface of the web 500 to provide wetting of the web 500. The amount of water added should be adjusted to

an effective level in order to preserve the clarity of the emboss pattern. Preferably, at least about 0.25 gram per gram of fiber weight, more preferably at least about 0.28 gram per gram of fiber weight should be added to the web of fibers. Applicant has found that for the above described mixture of cellulosic and polyester fibers, a wetting level of less than about 0.22 gram/ gram can result in loss of clarity of the web emboss pattern when an opacifying agent is used. Without being limited by theory, it is believed that wetting in an amount of at least 0.25 gram per gram and more preferably at least about 0.28 gram per gram of fiber weight helps to ensure clarity of the web emboss pattern when an opacifying agent is added to the web.

The wetted web 500 is next carried through an embossing nip formed between a rubber anvil roll 740 and a steel pattern roll 742. The rubber anvil roll 740 has a P&J hardness of about 17.5. The steel pattern roll can have a land area (corresponding to the embossments formed in the web) which is between about 12 and about 20 percent of the surface of the pattern roll. The nip load should be adjusted to an effective level for maintaining clarity of the emboss pattern. For a land area of about 12 percent, it is believed that the emboss nip should provide a nip loading of at least about 300 pli, corresponding to a nip pressure of at least about 2500 psi, and more preferably a nip loading of at least about 360 pli corresponding to a nip pressure of at least about 3000 psi. It has been found that below a nip loading of about 250 pli and nip pressure of about 2300 psi, clarity of emboss pattern suffers when an opacifying agent is added to the web.

The embossed web is transferred from the anvil roll 740 to a conveyor 810A, followed by transfer to a conveyor 810B. The embossed web 510 is then transferred to a conveyor 812 to have a first face of the embossed web 510 (the face of the web positioned against roll 742 during embossing) facing outwardly. The first face of the embossed web 510 is sprayed with a binder adhesive composition containing the opacifying agent. The binder adhesive is provided by a plurality of nozzles indicated by reference numeral 820 in Figure 4.

The web 510 is then transferred to a conveyor 814 such that the second face of the embossed web faces outwardly. A second plurality of nozzles indicated by reference numeral 830 is used to spray an binder adhesive containing the opacifying agent onto the second face of the embossed web. In a preferred embodiment, the opacifying agent comprises titanium dioxide, and the binder adhesive composition comprises latex and at least about 2 grams, more preferably at least about 4 grams,

and even more preferably at least about 5 grams of titanium dioxide solids per 100 grams of latex adhesive solids.

The embossed web 510 is then carried through drying ovens 900 to dry the web and to cure the binder adhesive.

EXAMPLE:

According to one exemplary embodiment, a premoistened wipe according to the present invention comprises an airlaid nonwoven web wetted with an aqueous liquid composition comprising about 97 percent by weight water. The balance of the liquid composition comprises Propylene Glycol, PEG-75 Lanolin, Cocoamphodiacetate, Polysorbate 20, Methylparaben, Propylparaben, 2-Bromo-2-Nitropropane-1, 3-Diol, and fragrance.

The nonwoven web comprises about 73.5 percent by dry weight cellulosic fibers (Southern softwood Kraft having an average fiber length of about 2.6 mm); about 10.5 percent by dry weight polyester fibers having a denier of about 1.35 and a staple length of about 0.85 inch; and about 16 percent by dry weight adhesive binder solids, the adhesive binder solids including titanium dioxide. The basis weight of the substrate is about 64 grams per square meter. and the density of the substrate prior to lotionizing (wetting) with the liquid composition is about 0.054 grams per cubic centimeter.

The airlaid web is wetted and embossed prior to application of the adhesive binder. The airlaid web is wetted with about 0.28 grams of water per gram of dry fiber weight prior to embossing. The wetted web is then embossed with a patterning roll having a land area of about 12 percent, and with a nip loading of about 360 pli and a nip pressure of about 3000 psi. The binder adhesive is then sprayed on the both surfaces of the web in an amount sufficient to provide a dry nonwoven web having about 16 percent by dry weight binder adhesive solids. The web has a basis weight of about 63.6 grams per square meter.

The adhesive binder solids comprise primarily latex (styrene-butadiene) solids. The adhesive binder solids also include Cymel 303 (malamine formaldehyde) (available from American Cyanamid of Wayne, NJ) in the amount of about 6 percent by weight of the latex solids; Aerosol GPG (dioctyl sulfosucinate) (available from American Cyanamid) in the amount of about 4.3 percent by weight of the latex solids; ammonium chloride in the amount of about 1.35 percent by weight of the

latex solids; and titanium dioxide in the amount of about 5 percent by weight of the latex solids.

The adhesive binder is made according to the following procedure. About 22,500 pounds of Rovene 5550 (49 percent solids styrene butadiene) latex adhesive available from Mallard Creek Polymers of Charlotte, N.C. is introduced into an adhesive mix tank. Separately, about 716 pounds of a slurry of water and titanium dioxide solids (about 77 percent by weight titanium dioxide solids) is provided. The slurry is commercially available from the Kemira Pigments, Inc. of Savannah, GA under the commercial designation UDR-606. The titanium dioxide slurry and about 5000 pounds of cold water are mixed together in a mix tank for 30 minutes, and then added to the Rovene 5550 in the adhesive mix tank. This mixture of cold water, titanium dioxide slurry, and Rovene 5550 is constantly agitated in the adhesive mix tank.

Separately, 5000 pounds of hot water are introduced into a chemical mix tank. About 677 pounds of Aerosel GPG (70 percent solids) and about 668 pounds of Cymel 303 (99 percent solids) are added to the hot water, and this mixture is agitated for 45 minutes. After 45 minutes, the mixture of hot water, Aerosel GPG, and Cymel 303 is added to the latex/titanium dioxide mixture in the adhesive mix tank, and the mixture in the adhesive mix tank is constantly agitated.

Then, 5000 pounds of cold water and about 150 pounds of ammonium chloride are added to the chemical mix tank, and the mixture in the chemical mix tank is agitated for 45 minutes. The mixture in the chemical mix tank is then added to the mixture in the adhesive mix tank, and the resulting liquid adhesive binder mixture in the adhesive mix tank is agitated for one hour before application to the web.

Prior to application to the web, the liquid adhesive binder mixture is diluted with water to between about 21 percent and about 25 percent total solids.

The web is premoistened with an aqueous liquid composition comprising about 97% by weight water.

The resulting premoistened wipe has an average liquid loading of 3.08 grams per gram (Saturation percentage of 308 percent), and an average normalized opacity of 72.2.

TEST METHODS:

BASIS WEIGHT:

The basis weight of the substrate is the weight of the dry substrate per unit area, and can be expressed in grams per square meter of dry substrate.

CALIPER:

The caliper of the dry substrate is measured with a circular load foot having an area of about 2 square inches and which provides a confining pressure of about 95 grams per square inch. The caliper is measured prior to lotionizing the dry substrate with the liquid composition.

DENSITY:

The density of the dry substrate is obtained by dividing the basis weight by the caliper, using consistent units. The density is measured prior to lotionizing the dry substrate with the liquid composition.

OPACITY:

The average normalized opacity is determined using the following procedure. Opacity measurements are made using a Technidyne Model BNL-3 Opacimeter manufactured by the Technidyne Corporation of New Albany, Indiana, which opacimeter conforms to TAPPI Test Method T425 om-91. The opacimeter provides an opacity reading which is a nondimensional ratio of the amount of light reflected from a sample when the sample is backed by a black body to the amount of light reflected from the sample when the sample is backed by a white body.

The opacimeter includes a standard black backing, a standard white backing, an incandescent light source, an infrared absorbing filter, a photocell, and an integrating cavity.

The opacimeter is allowed to warm up for at least 20 minutes, and is calibrated with opal glass opacity standards.

The opacity values are determined for premoistened samples. The sample is placed on the opacimeter so that the opacity measurements are taken in the

background (nonembossed) portion of the premoistened wipe, if possible. If it is not possible to avoid embossed portions while taking the measurements, the opacity measurements should be taken in the portion of the substrate having the least amount of embossing. The sample is first backed with the standard white backing, to provide an instrument reading of 100. The white backing is then replaced with the black backing, and the instrument meter provides the contrast ratio. This contrast ratio, expressed as a percentage between 1-100 percent, is the opacity value for the sample.

Sampling: The opacity values are determined for premoistened samples. In order to account for differences in lotion loading within a package of premoistened wipes, at least ten samples from two separate packages (e. g., tub, bottle, refill pack) are measured to provide a total of at least 20 opacity measurements (10 from each of two packages.) The average of these measurements provides the "average opacity value."

If the premoistened wipes are packaged in recognizable groups, at least one sample should be measured from each recognizable group within the package. For instance, premoistened wipes packaged in tub type containers may be grouped in identifiable "clips" corresponding to grouping of the wipes during converting and packaging. By way of example, if a tub of wipes has 16 clips of 6 wipes (96 total), then at least one wipe from each of the 16 clips should be measured. If a tub of wipes has 10 clips of 8 wipes (80 wipes total), then at least one wipe from each of the 10 clips should be measured.

For each of the samples measured for opacity, the wet sample weight and dry sample weight is also measured so that the liquid loading (grams liquid composition/gram dry substrate) can be determined. The dry sample weight can be determined by weighing the sample prior to adding the liquid composition to the substrate, or alternatively, by evaporating the liquid composition from the substrate. The average of the liquid loading values for the samples provides the "average liquid loading"

Normalized Opacity:

The average normalized opacity is determined from the average measured opacity according to the following equation:

$$ANO = AO + (ALL/0.27) + (0.544)*(63.6-BW)$$

where:

ANO is the Average Normalized wet opacity, a number between 1 and 100

AO is the Average wet opacity, a number between 1 and 100.

ALL is the Average liquid loading (grams liquid/grams dry substrate)

BW is the basis weight in grams per square meter

For example, for an average saturation of 308 percent, a basis weight of 63.6 grams per square meter, and an average opacity of 60.8, the average liquid loading is 3.08 and the average normalized wet opacity is

$$60.8 + (3.08/0.27) + (0.544)*(63.6-63.6) = 72.2.$$

COMPARATIVE DATA:

Tables 1, 2, 3, 4, and 5 list comparative opacity data. Table 1 provides data for a premoistened wipes made according to the present invention, the premoistened wipes comprising a substrate having an average basis weight of 63.6 grams per square meter, the substrate comprising about 73.5 percent by dry weight cellulosic fibers, about 10.5 percent by dry weight polyester fibers, and about 16 percent by dry weight adhesive binder, and the adhesive binder composition comprising titanium dioxide solids in the amount of about 5 percent of the weight of the latex solids in the adhesive binder composition.

Table 2 provides data for premoistened wipes not including titanium dioxide, but otherwise having generally the same basis weight and fiber composition as the wipes in Table 1. These premoistened wipes are commercially available as "Pampers Baby Fresh" brand baby wipes commercially available from The Procter and Gamble Co.

Table 3 provides data for a premoistened wipes made according to the present invention, the premoistened wipes comprising a substrate having a dry basis weight of 71.3 grams per square meter, and the substrate comprising about 73.5 percent by dry weight cellulosic fibers, about 10.5 percent by dry weight polyester fibers, and

about 16 percent by dry weight adhesive binder, and the adhesive binder composition comprising titanium dioxide solids in the amount of about 5 percent of the weight of the latex solids in the adhesive binder composition.

Table 4 provides data for premoistened wipes not including titanium dioxide, but otherwise having generally the same basis weight and fiber composition as the wipes in Table 3.

Table 5 provides data for a commercially available premoistened wipe which comprises a nonwoven web of meltblown polypropylene fibers and cellulosic fibers.

The tables include data for samples taken from two tub type packages. The average saturation listed in the tables is the average liquid loading multiplied by 100 and expressed as a percent.

Table 1: Basis Weight 63.6 gsm With TiO2

	tub #1			tub #2		
	opacity	sat%	norm op	opacity	sat%	norm op
top	67.8	187%	74.72	69.6	187%	76.52
2	66.4	207%	74.08	64.2	207%	71.88
3	67.0	207%	74.68	64.7	228%	73.14
4	62.2	224%	70.49	61.5	224%	69.79
5	61.8	244%	70.85	64.2	240%	73.09
6	60.3	248%	69.50	61.3	261%	70.95
7	61.9	265%	71.71	61.1	257%	70.60
8	63.2	277%	73.46	61.4	302%	72.57
9	60.6	289%	71.32	58.6	302%	69.77
10	58.5	318%	70.28	56.1	310%	67.58
11	56.2	359%	69.50	59.8	351%	72.79
12	64.1	380%	78.16	59.7	359%	73.00
13	56.8	396%	71.46	55.1	416%	70.52
14	56.9	429%	72.78	57.8	429%	73.68
15	54.3	425%	70.03	60.8	445%	77.28
bottom	55.1	420%	70.67	57.7	461%	74.79

average wet opacity	60.8
average saturation	308%
average basis weight	63.6
average normalized wet opacity	72.2

Table 2: Basis Weight 63.6 gsm Without TiO2

	tub #1			tub #2		
	opacity	sat%	norm op	opacity	sat%	norm op
top	56.7	195%	63.93	56.3	199%	63.68
2	58.8	199%	66.18	59.9	207%	67.58
3	55.7	216%	63.68	54.5	179%	61.12
4	57.5	240%	66.39	60.1	216%	68.08
5	53.4	203%	60.93	59.0	248%	68.20
6	56.3	228%	64.74	52.1	277%	62.36
7	52.1	248%	61.30	52.2	277%	62.46
8	56.0	281%	66.41	53.9	289%	64.62
9	58.6	314%	70.23	53.2	220%	61.34
10	53.5	334%	65.89	53.2	355%	66.35
11	54.7	359%	68.00	52.7	343%	65.39
12	49.9	380%	63.96	54.1	375%	68.00
13	47.4	375%	61.30	53.8	396%	68.46
14	48.8	420%	64.37	47.4	416%	62.82
15	55.3	412%	70.57	51.7	457%	68.64
bottom	48.7	441%	65.03	48.7	449%	65.34

average wet opacity	53.9
average saturation	305%
average basis weight	63.6
average normalized wet opacity	65.2

Table 3. Basis Weight 71.3 gsm With TiO2

	tub #1			tub #2		
	opacity	sat%	norm op	opacity	sat%	norm op
top	64.6	192%	67.52	65.5	181%	68.02
2	66.2	203%	69.53	64.2	210%	67.80
3	64.0	214%	67.73	66.7	214%	70.43
4	64.5	236%	69.04	61.6	228%	65.87
5	64.9	228%	69.17	59.4	218%	63.27
6	66.5	232%	70.91	65.3	269%	71.06
7	66.3	276%	72.33	56.9	221%	60.90
8	68.3	276%	74.33	63.4	287%	69.84
9	58.4	323%	66.19	61.9	309%	69.15
10	67.3	345%	75.90	61.6	298%	68.44
11	56.1	353%	64.97	57.0	345%	65.60
12	61.5	378%	71.31	57.9	371%	67.44
13	58.2	393%	68.56	57.1	389%	67.32
14	58.5	455%	71.15	58.8	422%	70.24
15	57.0	429%	68.71	52.1	407%	63.00
bottom	58.8	440%	70.91	52.2	440%	64.31

average wet opacity	61.3
average saturation	306%
average basis weight	71.3
average normalized wet opacity	68.5

Table 4: Basis Weight 71.3 gsm Without TiO2

	tub #1			tub #2		
	opacity	sat%	norm op	opacity	sat%	norm op
top	62.8	199%	65.99	58.8	199%	61.99
2	59.2	199%	62.39	62.5	218%	66.37
3	63.0	221%	67.00	65.2	236%	69.74
4	56.1	221%	60.10	62.6	239%	67.28
5	62.8	228%	67.07	61.4	265%	67.02
6	64.1	250%	69.18	57.4	243%	62.21
7	60.5	265%	66.12	59.2	269%	64.96
8	61.5	294%	68.21	59.6	294%	66.31
9	59.5	312%	66.88	63.2	294%	69.91
10	58.3	316%	65.82	56.4	353%	65.27
11	59.1	371%	68.64	52.3	353%	61.17
12	54.6	367%	64.01	57.9	382%	67.85
13	56.4	389%	66.62	52.5	393%	62.86
14	50.6	400%	61.23	52.2	404%	62.96
15	53.2	411%	64.23	51.2	429%	62.91
bottom	53.4	436%	65.38	52.7	411%	63.73

average wet opacity	58.1
average saturation	308%
average basis weight	71.3
average normalized wet opacity	65.4

Table 5: Commercially Available Product
Basis Weight 77.2 gsm

	tub #1			tub #2		
	opacity	sat%	norm op	opacity	sat%	norm op
top	64.8	235%	66.09	74.5	224%	75.40
2	70.9	235%	72.19	73.4	235%	74.69
3	73.5	245%	75.18	65.7	242%	67.25
4	71.1	259%	73.30	62.7	252%	64.64
5	66.9	266%	69.36	68.8	266%	71.26
6	65.5	277%	68.35	61.1	284%	64.21
7	67.2	294%	70.70	67.4	298%	71.03
8	65.7	301%	69.46	65.1	319%	69.52
9	59.0	319%	63.42	66.7	330%	71.51
bottom	62.9	340%	68.10	65.4	368%	71.64

average wet opacity	66.9
average saturation	279%
average basis weight	77.2
average normalized wet opacity	69.9

WHAT IS CLAIMED IS:

1. A premoistened wipe comprising a substrate wetted with an aqueous liquid composition, wherein the premoistened wipe has an average normalized wet opacity of at least about 71.

2. The premoistened wipe of Claim 1 having an average liquid loading of at least about 2.0 grams per gram of dry substrate, and more preferably at least about 3.0 grams per gram of dry substrate.

3. The premoistened wipe of Claims 1 or 2 wherein the substrate has a dry density of less than about 0.10 grams per cubic centimeter.

4. The premoistened wipe of Claims 1, 2, or 3 wherein the substrate has a dry basis weight of between about 40 grams/square meter and about 80 grams/square meter.

5. The premoistened wipe of Claims 1, 2, 3, or 4 wherein the substrate comprises at least about 50 percent by dry weight cellulosic fibers, and more preferably at least about 70 percent by dry weight cellulosic fibers.

6. The premoistened wipe of Claims 1, 2, 3, 4, or 5 wherein the premoistened wipe comprises a plurality of embossed regions dispersed throughout a background region of the substrate, and wherein the embossed regions are relatively less opaque than the background.

7. The premoistened wipe of Claims 1, 2, 3, 4, 5, or 6 wherein the substrate comprises synthetic fibers having a denier greater than about 1.0 gram/9000 meter of fiber length.

8. A premoistened wipe comprising a nonwoven web wetted with an aqueous liquid composition, wherein the nonwoven web includes an opacifying agent having a refractive index greater than 1.40, and more preferably greater than 1.60.

9. The premoistened wipe of Claims 1, 2, 3, 4, 5, 6, 7, or 8 wherein the premoistened wipe comprises titanium dioxide.

10. The premoistened wipe of Claims 1, 2, 3, 4, 5, 6, 7, 8, or 9 wherein the dry nonwoven web comprises between about 0.3 percent and about 1.0 percent by dry weight titanium dioxide.

11. A method of forming a nonwoven web comprising the steps of:

forming an airlaid web of fibers; and

adding an opacifying agent having a refractive index greater than 1.40, more preferably greater than about 1.60, to the airlaid web of fibers.

12. The method of Claim 11 wherein the step of adding an opacifying agent comprises adding titanium dioxide.

13. The method of Claims 11 or 12 wherein the step of forming an airlaid web of fibers comprises forming an airlaid web comprising at least 50 percent, more preferably at least 70 percent by dry weight cellulosic fibers.

14. The method of Claims 11, 12, or 13 further comprising the step of embossing the airlaid web of fibers.

15. The method of Claim 14 wherein the step of adding the opacifying agent is performed after the step of embossing the airlaid web of fibers.

16. The method of Claims 14 or 15 further comprising the step of wetting the web prior to the step of embossing the web.

The Patent Office

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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

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Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	EP0186208A2 (PWA Waldhof) see whole documet, e.g. page 5 lines 8-13	1-10
X	US4853281 (Win) see whole document, e.g. col 3 lines 1-29	1-4,6-10
X	WPI Abstract Accession No. 93-070207(09) & JP 050015468 A (Harima Kasei) 26/01/93 see abstract	1-10
X	WPI Abstract Accession No. 93-070206(09) & JP 050015467 A (Harima Kasei) 26/01/93 see abstract	1-10
X	WPI Abstract Accession No. 89-237385(33) & JP 010171523 A (Lion Corp) 06/07/89 see abstract	1-10

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.